Smart Innovation, Systems and Technologies 141

Arun K. Somani · Rajveer Singh Shekhawat ·
Ankit Mundra · Sumit Srivastava ·
Vivek Kumar Verma *Editors*

Smart Systems and IoT: Innovations in Computing

Proceeding of SSIC 2019

KES International

Springer

Smart Innovation, Systems and Technologies

Volume 141

The Smart Innovation, Systems and Technologies book series encompasses the topics of knowledge, intelligence, innovation and sustainability. The aim of the series is to make available a platform for the publication of books on all aspects of single and multi-disciplinary research on these themes in order to make the latest results available in a readily-accessible form. Volumes on interdisciplinary research combining two or more of these areas is particularly sought.

The series covers systems and paradigms that employ knowledge and intelligence in a broad sense. Its scope is systems having embedded knowledge and intelligence, which may be applied to the solution of world problems in industry, the environment and the community. It also focusses on the knowledge-transfer methodologies and innovation strategies employed to make this happen effectively. The combination of intelligent systems tools and a broad range of applications introduces a need for a synergy of disciplines from science, technology, business and the humanities. The series will include conference proceedings, edited collections, monographs, handbooks, reference books, and other relevant types of book in areas of science and technology where smart systems and technologies can offer innovative solutions.

High quality content is an essential feature for all book proposals accepted for the series. It is expected that editors of all accepted volumes will ensure that contributions are subjected to an appropriate level of reviewing process and adhere to KES quality principles.

**** Indexing: The books of this series are submitted to ISI Proceedings, EI-Compendex, SCOPUS, Google Scholar and Springerlink ****

More information about this series at https://link.springer.com/bookseries/8767

Arun K. Somani · Rajveer Singh Shekhawat ·
Ankit Mundra · Sumit Srivastava ·
Vivek Kumar Verma
Editors

Smart Systems and IoT: Innovations in Computing

Proceeding of SSIC 2019

Springer

Editors
Arun K. Somani
College of Engineering
Iowa State University
Ames, IA, USA

Ankit Mundra
Department of Information Technology
Manipal University Jaipur
Jaipur, Rajasthan, India

Vivek Kumar Verma
School of Computing and Information Technology
Manipal University Jaipur
Jaipur, Rajasthan, India

Rajveer Singh Shekhawat
School of Computing and Information Technology
Manipal University Jaipur
Jaipur, Rajasthan, India

Sumit Srivastava
Department of Information Technology
Manipal University Jaipur
Jaipur, Rajasthan, India

ISSN 2190-3018 ISSN 2190-3026 (electronic)
Smart Innovation, Systems and Technologies
ISBN 978-981-13-8405-9 ISBN 978-981-13-8406-6 (eBook)
https://doi.org/10.1007/978-981-13-8406-6

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Contents

1 **Statistical Image Processing for Enhanced Scientific Analysis** 1
Deepak Kumar

2 **Performance Analysis of Network with Different Queuing Mechanisms in TCP/FTP and UDP/FTP Scenario** 13
Nehal Patel and Radhika Patel

3 **Wireless Sensor Network: A Possible Solution for Crowd Management** 23
Jenny Kasudiya, Ankit Bhavsar and Harshal Arolkar

4 **Artificial Neural Networks Based Green Energy Harvesting for Smart World** 33
Tigilu Mitiku and Mukhdeep Singh Manshahia

5 **Design of IoT-Based SmartMat** 39
Rutba Mufti, Kartike Khatri, Sumit Bhardwaj and Punit Gupta

6 **SMS Enabled Smart Vehicle Tracking Using GPS and GSM Technologies: A Cost-Effective Approach** 51
Pankaj Kumar Sanda, Sidhartha Barui and Deepanwita Das

7 **The MANI Protocol for Intra-Vehicular Networking** 63
N. Sumedh, Mangala Sneha Srinivasan, Sagar Basavaraju and Nidhi Gangrade

8 **Multi-criteria Group Recommender System Based on Analytical Hierarchy Process** 75
Nirmal Choudhary and K. K. Bharadwaj

9 **Dimensionality Reduction for Insect Bites Pattern Recognition** 85
Abdul Rehman Khan, Nitin Rakesh and Rakesh Matam

10 **Short Term Pollution Index Prediction Using Principles of Machine Learning** 95
Siddhant Goswami, Dinesh Singh Shekhawat, Neetu Faujdar, Nitin Rakesh, P. K. Rohatgi and Karan Gupta

11 **DomSent: Domain-Specific Aspect Term Extraction in Aspect-Based Sentiment Analysis** 103
Ganpat Singh Chauhan and Yogesh Kumar Meena

12 **IoT-Based Smart Car for Safety of Elderly People** 111
Karan Gupta, Nitin Rakesh, Neetu Faujdar, Nidhi Gupta, Deepak Vaswani and Kuldeep Singh Shivran

13 **IoT Based Solution for Automation of Hospital activities with High Authentication** 121
Karan Gupta, Nitin Rakesh, Neetu Faujdar and Nidhi Gupta

14 **Analysis and Comparison of Sensor Node Scheduling Heuristic for WSN and Energy Harvesting WSN** 131
Sakar Gupta and Sunita Gupta

15 **Child Count Based Load Balancing in Routing Protocol for Low Power and Lossy Networks (Ch-LBRPL)** 141
A. Sebastian

16 **A Dielectric Modulated Polarity Controlled Electrically Doped Junctionless TFET Biosensor for IOT Applications** 159
Deepak Soni, Amit Kumar Behera, Dheeraj Sharma, Mohd. Aslam and Shivendra Yadav

17 **Algorithm Selection via Meta-Learning and Active Meta-Learning** 169
Nirav Bhatt, Amit Thakkar, Nikita Bhatt and Purvi Prajapati

18 **Effect of Metallic Strip Deposition Within the Source Dielectric with Applied Double Metallic Drain for Enhanced DC/RF Behavior of Charge Plasma TFET for Low-Power IOT Applications** 179
Mohd. Aslam, Dheeraj Sharma, Deepak Soni and Shivendra Yadav

19 **Analysis of Coverage Hole Problem in Wireless Sensor Networks** 187
Neeru Meena and Buddha Singh

20 **Community Detection Using Maximizing Modularity and Similarity Measures in Social Networks** 197
Laxmi Chaudhary and Buddha Singh

21 Subgame Perfect Equilibrium-Based Framework for Counterterror Solution Modeling 207
Saurabh Ranjan Srivastava, Yogesh Kumar Meena and Girdhari Singh

22 A Broadband Microstrip Patch Antenna for C-Band Wireless Applications 219
P. Kumar and G. Singh

23 Rule-Based Derivational Stemmer for Sindhi Devanagari Using Suffix Stripping Approach. 227
Bharti Nathani, Nisheeth Joshi and G. N. Purohit

24 Slow Speed Alert for Speed Breakers and Potholes Using IoT and Analytics in the Context of Smart Cities 237
Sathish Kumar Soundararaj, P. Bagavathi Sivakumar and V. Ananthanarayanan

25 Localization and Indoor Navigation for Visually Impaired Using Bluetooth Low Energy 249
Bhalaji Nagarajan, Valliappan Shanmugam, V. Ananthanarayanan and P. Bagavathi Sivakumar

26 Compact Circularly Polarized Symmetric Fractal Slits Loaded Micro-strip Antenna 261
Shashi Kant Pandey, Ganga Prasad Pandey and P. M. Sarun

27 Fog Computing-Based Environmental Monitoring Using Nordic Thingy: 52 and Raspberry Pi 269
P. Divya Bharathi, V. Ananthanarayanan and P. Bagavathi Sivakumar

28 A Note on Wired and Wireless Sensor Communication Using Arduino Board and NodeMCU. 281
Tanisha Dey Roy and Jaiteg Singh

29 Analysis of Archimedes' Spiral Based Wireless Sensor Network with Mobile Sink. 293
Ranjana Thalore, Raunak Monir, Jeetu Sharma, Vikas Raina, P. P. Bhattacharya and V. K. Jain

30 Word Embeddings for Semantic Resemblance of Substantial Text Data: A Comparative Study 303
Kazi Lutful Kabir, Fardina Fathmiul Alam and Anika Binte Islam

31 Automated Ethereum Smart Contract for Block Chain Based Smart Home Security 313
Amjad Qashlan, Priyadarsi Nanda and Xiangjian He

32 SecureDorm: Sensor-Based Girls Hostel Surveillance System 327
Shreyansh Sharad Jain, Gaurav Singal, Deepak Garg and Suneet Kumar Gupta

33 Improvement in XML Keyword Search and Ranking for Data Analytics 339
Vasudev Yadav, Pradeep Tomar, Prabhjot Singh and Gurjit Kaur

34 Attacks and Their Solution at Data Link Layer in Cognitive Radio Networks 351
Gurjit Kaur, Pradeep Tomar, Archit Agrawal and Prabhjot Singh

35 Interactive Electricity Consumption System 363
Gresha Bhatia, Gurpreet Singh Nagpal, Samujjwaal Dey, Ashish Joshi and Nadiminti Sai Sirisha

36 Development of Artificial Neural Network to Predict the Concrete Strength 379
Yaman Parasher, Gurjit Kaur, Pradeep Tomar and Akshay Kaushik

37 Potato Crop Disease Classification Using Convolutional Neural Network 391
Mohit Agarwal, Amit Sinha, Suneet Kr. Gupta, Diganta Mishra and Rahul Mishra

38 Intelligent Voice Bots for Digital Banking 401
Ravneet Kaur, Ravtej Singh Sandhu, Ayush Gera, Tarlochan Kaur and Purva Gera

39 The Internet of Things Based Water Quality Monitoring and Control 409
Neha Dalwadi and Mamta Padole

40 Internet of Things: Risk Management 419
Vinita Malik and Sukhdip Singh

41 A Survey on Devanagari Character Recognition 429
Ankit K. Sharma, Dipak M. Adhyaru and Tanish H. Zaveri

42 An Advanced Algorithm for Perfect Image Selection Based on Quality Matrix 439
Kiran Jeswani and Mukesh Gupta

43 Cross-Domain Authentication and Interoperability Scheme for Federated Cloud 451
Monika Gogna and C. Rama Krishna

44 Detecting Suspicious Users in Social Networks Using Text Analysis 463
Nisha Kundu and Yogesh Kumar Meena

45 Smart Compact-Folded Microstrip Antenna for GSM, LTE, and WLAN Applications 475
Amit Birwal, Sanjeev Singh and Binod Kumar Kanaujia

46 A Pixel-Based Digital Medical Images Protection Using Genetic Algorithm with LSB Watermark Technique 483
Gaurav Kumar Soni, Akash Rawat, Smriti Jain and Saurabh Kumar Sharma

47 Void Avoidance Node Deployment Strategy for Underwater Sensor Networks 493
Pradeep Nazareth and B. R. Chandavarkar

48 A Framework for e-Governance Using Federation of Cloud 503
Ashutosh Gupta, Praveen Dhyani, O. P. Rishi and Vishwambhar Pathak

49 "Computing with Words"-Based Concept Retrieval 513
Bushra Siddique and M. M. Sufyan Beg

50 Emotion Recognition on E-Learning Community to Improve the Learning Outcomes Using Machine Learning Concepts: A Pilot Study 521
A. Jithendran, P. Pranav Karthik, S. Santhosh and J. Naren

51 Improving the Model Performance of Deep Convolutional Neural Network in MURA Dataset 531
Shubhajit Panda and Mahesh Jangid

52 Vulgarity Classification in Comments Using SVM and LSTM 543
Crystal Dias and Mahesh Jangid

53 Network Packet Breach Detection Using Cognitive Techniques 555
Priyadarsi Nanda, Abid Arain and Upasana Nagar

54 Efficient Channel Access Scheme with Low Congestion Lane Selection in Vehicular Ad Hoc Network 567
Pradeep Kumar Tiwari, Maya Pandey and Manish Sharma

55 Railway Control and Alert When Train Is on Wrong Track and Derail Due to Obstruction 579
Aaradhya Agarwal, Sumit Bhardwaj and Punit Gupta

56 An Overview of Application Scenarios of Voice over Wireless Sensor Networks 587
Rohit Mathur, Dungar Nath Chouhan and Tarun Kumar Dubey

57 The QoS Evaluation of WSN Using Different Number of Mobile Sink Nodes Underwater 595
Vikas Raina, Jeetu Sharma, Ranjana Thalore and Partha Pratim Bhattacharya

58 Internet of Streetlights for Energy Efficient Smart Lighting System 609
Vibhanshu Singh and Sangeeta Mittal

59 Linking Green Supply Chain Management, Co-creation, and Sustainability: Empirical Revisit in Indian Manufacturing Sector Context 617
Sashikala Parimi and Samyadip Chakraborty

60 Digital Solution to Combat Training 631
Bharat Sharma, Bhuvidha Singh Tomar, Chander Bhuvan, Sumit Bhardwaj and Prakash Kumar

61 Image Encryption Decryption Using Simple and Modified Version of AES 641
Ravi Nahta, Tarun Jain, Abhishek Narwaria, Horesh Kumar and Rohit Kumar Gupta

62 Model for Classification of Poems in Hindi Language Based on Ras 655
Kaushika Pal and Biraj V. Patel

63 Object Motion Detection Methods for Real-Time Video Surveillance: A Survey with Empirical Evaluation 663
Surender Singh, Ajay Prasad, Kingshuk Srivastava and Suman Bhattacharya

64 Analysis of Wormhole Attack on AODV and DSR Protocols Over Live Network Data 681
Harsh Kishore Mishra and Meenakshi Mittal

65 Identifying Non-pulsar Radiation and Predicting Chess Endgame Result Using ARSkNN 691
Yash Agarwal, Ashish Kumar, Roheet Bhatnagar and Sumit Srivastava

66 Assessing and Exploiting Security Vulnerabilities of Unmanned Aerial Vehicles 701
Fekadu Lakew Yihunie, Aman Kumar Singh and Sajal Bhatia

67 Image Steganography Using LSB Substitution: A Comparative Analysis on Different Color Models 711
Avneesh Nolkha, Sunil Kumar and V. S. Dhaka

68 Comparison-Based Study of PageRank Algorithm Using Web Structure Mining and Web Content Mining 719
Nitesh Pradhan and V. S. Dhaka

69 Internet of Things Enabled Innovation Constructs in Third-Party Logistics—An Empirical Validation 731
Samir Yerpude and Tarun Kumar Singhal

70 Cloud-Assisted IoT-Enabled Smoke Monitoring System (e-Nose) Using Machine Learning Techniques 743
Somya Goyal, Pradeep K. Bhatia and Anubha Parashar

71 IoT-Based Cloud-Enabled Smart Electricity Management System 755
Apoorva Parashar and Anubha Parashar

72 Real-Time Object Detection and Tracking Using Velocity Control 767
Geeta Rani and Anita Jindal

73 A Review on View-Invariant Human Gesture Encroachments 779
Ayush Mittal and Bhavesh Singh Jaggi

74 A Survey on Crowd Video Exploration Using Physical Enthused Approaches 791
Bhanu Kanwar Bhati and Ayushi Aggawal

75 Impacts of Change in Facial Features on Age Estimation and Face Identification: A Review 801
Hitendra Singh Shekhawat and Hitendra Singh Rathor

76 RETRACTED CHAPTER: Remote Sensing Classification Under Deep Learning: A Review 813
Manoj Kumar Sharma and Harshit Verma

77 Recommendation System for Students' Course Selection 825
J. Naren, M. Zarina Banu and S. Lohavani

78 Design of a Novel Circularly Polarized Patch Antenna on Elliptical Structure 835
Sumanta Kumar Kundu, Shashank Jaiswal and Pramod Kumar Singhal

79 Indian Sign Language Spelling Finger Recognition System 845
J. Naren, R. Venkatesan, P. Rajendran, Galla Sai Vasudha and Vivek

80 Compact and Secure S-Box Implementations of AES—A Review 857
Amrik Singh, Ajay Prasad and Yoginder Talwar

Correction to: Smart Systems and IoT: Innovations in Computing C1
Arun K. Somani, Rajveer Singh Shekhawat, Ankit Mundra, Sumit Srivastava and Vivek Kumar Verma

Retraction Note to: Remote Sensing Classification Under Deep Learning: A Review C3
Manoj Kumar Sharma and Harshit Verma

Author Index 873

About the Editors

Arun K. Somani is currently Anson Marston Distinguished Professor and Jerry R. Junkins Endowed Chair Professor of Electrical and Computer Engineering at Iowa State University. His research interests include fault-tolerant computing, computer interconnection networks, WDM-based optical networking, and reconfigurable and parallel computer system architecture. He architected, designed, and implemented the 46-node multi-computer cluster-based system, Proteus. He has served as an IEEE distinguished visitor, IEEE distinguished tutorial speaker, and has delivered several keynotes. He was elected as a Fellow of IEEE for his contributions to the "theory and applications of computer networks." He was made a Distinguished Scientist member of ACM in 2006.

Rajveer Singh Shekhawat is Professor & Director of the School of Computing & IT, Manipal University Jaipur. He completed his M.Sc., B. Tech. M.S. and Ph.D. at BITS, Pilani. He holds 4 patents: Software for PC EK22 3D co-ordinate capturing system (1996); Software Package for Digital Mapping Applications (1996); NF 205/96: An Electronic Device Useful for Measuring Three Dimensional Model and Ground Co-ordinates from Stereo-Photogrammetric Instruments, CSIR, 1996; and NF/92/90: An Electronic Device for High Speed Peer to Peer Data Communication, CSIR, 1988.

Ankit Mundra is an Assistant Professor at the School of Computer Science and IT, Manipal University Jaipur. He is currently pursuing a PhD in the area of Internet of Vehicles at Malaviya National Institute of Technology, Jaipur. His research interests include IoV, online fraud detection, and cyber-physical systems. He has published over 30 research articles in peer-reviewed international journals, book series, and conference proceedings.

Sumit Srivastava is a Professor of Information Technology with expertise in the domain of data analytics and image processing. He is also a senior member of IEEE. He has published more than 100 research papers in peer-reviewed international journals, book series and conference proceedings.

Vivek Kumar Verma is an Assistant Professor at the School of Computing & Information Technology, Manipal University Jaipur. His areas of expertise include image processing, and natural language processing. He has published several articles in peer-reviewed international journals, book series and conference proceedings.

Chapter 1
Statistical Image Processing for Enhanced Scientific Analysis

Deepak Kumar

Abstract Image acquired through various sensors accrue multi-faceted distortions due to the failure of either sensor or platform and consequently, images get distorted. But for any kind of image analysis, it is a prerequisite that each image pixel should be refurbished. In recompensing these, image processing assists in image restoring to its best possible natural form. Recent image processing techniques have significantly advanced and are capable of removing any kind distortions. The present work exhibits the statistical image processing approach, which has been tested over the Landsat series of satellite image having data gaps of approximately 22% of the loss from the normal scene area that occurred due to the failure of Scan Line Corrector (SLC). The method has precisely estimated the missing values to fill the data gaps in the images for making more visually sensible and analytical. The results presented and authenticated the statistical processing approach as a potential tool for gap filling of lost pixels for the satellite imagery, which can enable more scientific usage of the acquired data sets.

Keywords Optical sensors · Sensor applications · Pixel · Statistics · Sensor signal processing and sensor fusion

1.1 Introduction

Satellite remote sensing deals a wide range of image data with diverse characteristics in terms of temporal, spatial, radiometric and spectral resolutions. An image of 'superior quality' refers to higher spatial or higher spectral resolution, which can only be obtained by more advanced sensors. Remotely sensed images can be useful for a lot of interpretations without any intervention for better quality of the images.

D. Kumar (✉)
Amity Institute of Geoinformatics & Remote Sensing (AIGIRS), Amity University Uttar Pradesh, Amity University Campus, Sector-125, Gautam Buddha Nagar, Noida 201313, Uttar Pradesh, India
e-mail: deepakdeo2003@gmail.com; dkumar12@amity.edu

A. K. Somani et al. (eds.), *Smart Systems and IoT: Innovations in Computing*, Smart Innovation, Systems and Technologies 141,
https://doi.org/10.1007/978-981-13-8406-6_1

Satellite imagery assists in creating a knowledge base to address issues with the usage of scientific analysis investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge [1]. It uses the analysis methods based on empirical or measurable evidence subject to specific principles of reasoning to analyze data acquired from satellites or ground-based platforms using statistical and image analysis software to solve regional, national, and global problems in areas of natural resource management, urban planning, and climate and weather prediction [2].

However, many of the times, satellite images could have distortions in terms of data gaps. In order to improve the capability of analysis of these satellite images, a different approach for image processing is required [3]. Therefore, it is necessary and very useful to process images with the proper approach to achieving gap-filled image data with higher spatial information. But it will have a severe effect on the image interpretation and consequent analysis if some of the pixels or pixel elements/ digital number (DN) in the acquired satellite images are missing. These missing pixels are referred as gaps, which influence the process of image classification and ultimately hinder the spatial information contained in the pixel [4]. To recognize each object or features depending on the presence of original pixel data, so to achieve this, the various methods/approaches have been used for remote sensing image processing but almost all the methods have some distress in the image.

Restoration of missing or damaged portions of images is an ancient technique consisting of filling in the lost areas or modifying the damaged ones in a non-detectable technique [5]. Earlier image processing utilized the traditional methods which include image sharpening, image smoothing, image rectification and image restoration, image enhancement but very less attention has been paid for the image restoration in context to missing pixels [6].

This satellite imaging processing is a prerequisite for producing seamless sharpened images with fewer distortions and data loss for the applications [5]. It also helps in image quality improvement for better pattern recognition, object detection, content-based retrieval approaches [7]. Geographic object-based image analysis (GEOBIA) moreover augment to scientific analysis work for further spatial analysis in conjunction with classification and feature extraction approaches [8]. Hence, the current approach was attempted to improve the eminence of image processing for gap filling techniques.

The recent method was tested with the processing of Landsat 7 image having a noise frame in the scene, which occurred due to the failure of SLC (Scan Line corrector) led to the stripping or missing of the scan line in the satellite image. The usage of the image was challenging, therefore, ways to repatriate the data gaps was taken up for the current research [9]. The current work also encompasses the understanding of image processing techniques for the images having missing pixels to provide the finer datasets for analysis.

1.2 Methodology

Gap filling of the satellite images can be classified as a single source, multi-source, and hybrid methods. Multi-source methods involve more than one image for reconstruction. Single-source methods use the same image information to fill gaps. The hybrid method combines both of the above approaches [10]. Processing of images utilizes the techniques of remote sensing technology for image and signal processing of optical datasets with conjunction to the image enhancement, image restoration, machine intelligence, data fusion techniques [11]. Several methods are now available for the image improvement, which are embedded conventionally into the remote sensing software package but these correction modules need to be customized and parameterized with the appropriate methods and values to deliver the required results after the image processing procedure.

A. **Gap Filling of Landsat SLC-Off Single Scene**

Figure 1.1 illustrates the procedure followed for statistical image processing. The method is intended to modify neighboring pixels in a single Landsat 7 SLC-off scene, creating a final corrected image, which can be used for scientific analysis. The method was adapted with the help of ERDAS Imagine software for initial image processing as well as for final filled image verification. Here, the idea was to apply different mathematical matrix functions in an iterative manner (depending on the loss of pixel in the raw image) for gap filling in the satellite images. After examining various functions, matrix sizes, and properties, the best technique and matrix size were adopted based on a statistical matrix report of the corrected image block. The current approach of statistical image processing for ETM+ images was tested for gap filling of the distorted image that occurred due to instrumentation error, losses of image data during transmission. Table 1.1 exhibits the scientific significance and spectral characteristics of the ETM+ sensor bands.

By manipulating imagery data values and positions, it is possible to see features that would not normally be visible and to locate geo-positions of features that would otherwise be graphical [12]. The current image processing method focused on performing image enhancement to develop operational methodologies for finer spatiotemporal satellite image dataset usability at a wider scale. Therefore, the link/pipeline between the end-users' requirements and the scientific community for facilitating the required quality of datasets must be established. The shaded regions in Fig. 1.2a exhibits the data losses and red rectangular boxes (i.e., at upper and lower parts) which are in red show the regions considered/used for computing the values of missing pixels/digital numbers (DNs).

Though, the synergistic use of statistical image processing methodologies may result in the possibility of solving complex problems related to the data gaps in the imagery acquired by various sensors but still some more comparative studies for multiple test areas must be done for validation of the results. Therefore, the present study is a footstep effort aimed for image restoration through the state-of-the-art statistical techniques of gap filling.

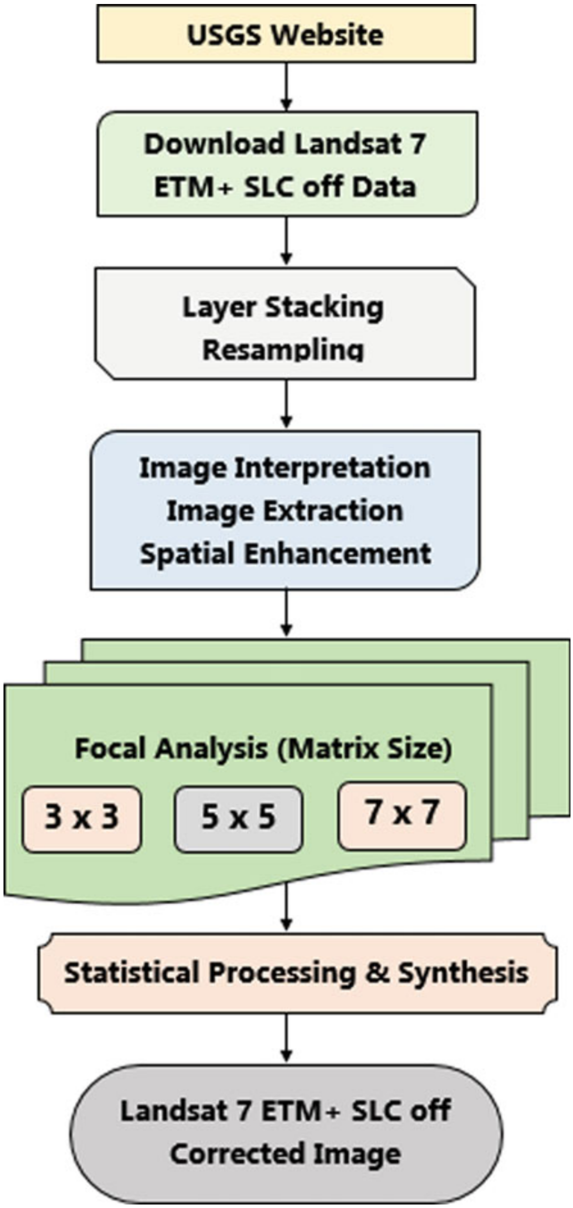


Fig. 1.1 Overview of statistical processing of SLC-off Landsat ETM+ images for scientific analysis

Table 1.1 Usability of Landsat 7 ETM+ different bands

Band	Spectral range (μm)	EMR region	Applications
1	0.45–0.52	Visible blue	Soil-vegetation discriminations, coastal water mapping
2	0.52–0.60	Visible green	Vegetation region assessment
3	0.63–0.69	Visible red	Chlorophyll absorption for vegetation
4	0.76–0.90	Near-infrared	Biomass assessment and water bodies différentiation
5	1.55–1.75	Middle infrared	Vegetation-soil moisture assessment and snow-cloud discrimination
6	10.40–12.50	Thermal infrared	Thermal mapping, soil moisture studies and plant heat stress studies
7	2.08–2.35	Middle infrared	Hydrothermal mapping
8	0.52–0.90	Near-infrared	Large area mapping, urban change studies

Source http://www.landcover.org/data/landsat/

Likewise, Fig. 1.2b exhibits the different filter sizes (i.e., 3 × 3 or 5 × 5 filter) used for processing of the image having the data losses.

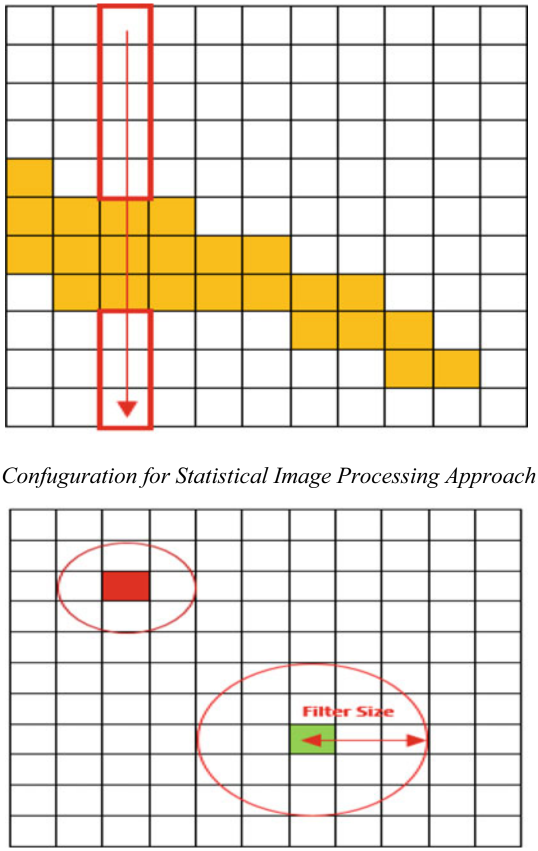
B. **Study Area and Dataset**

To evaluate the performance of our proposed technique, investigation was performed on real Landsat ETM+ data of unscanned location (obtained from Landsat ETM+ data) for Kalaburagi *(erstwhile Gulbarga)* City, Karnataka province, India (*Row 048 Path 145 in World Reference System 2, around 17°N and 76°E*). The major land cover types in this area include agricultural fields, urban area, forest, and bare soil. Corresponding bands 1-5 and 7 were used in level L1T obtained from the USGS website (http://glovis.usgs.gov/). Figure 1.3a exhibits the original raw image of the study area and Fig. 1.3b shows the subset of the same scene to showcase the missing pixels in the image.

C. **Software Tools and Methods/ Technology**

There are multiple systems/software for processing the satellites image using efficient algorithms to provide an enhanced image as an output. Commonly ERDAS Imagine *(a software application for satellite image processing)* is used to process the remote sensing data. For the current work, ERDAS Imagine 2014 were used for data processing, preparing and display of the enhanced digital images. It also facilitated to implement the various statistical techniques to augment several image processing algorithms.

Fig. 1.2 Overview of statistical processing and synthesis. **a** Configuration for statistical image processing approach. **b** Matrix size for the statistical processing method



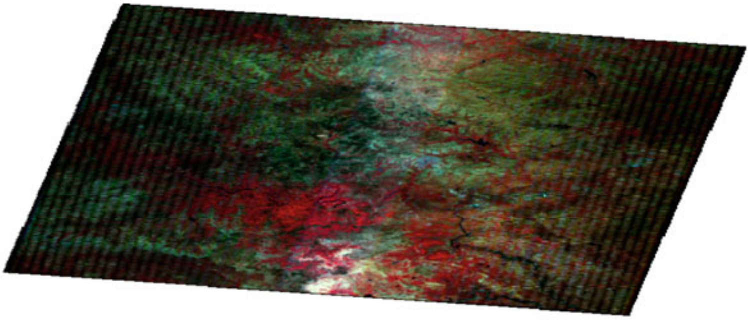
(a) Confuguration for Statistical Image Processing Approach

(b) Matrix size for statistical processing method

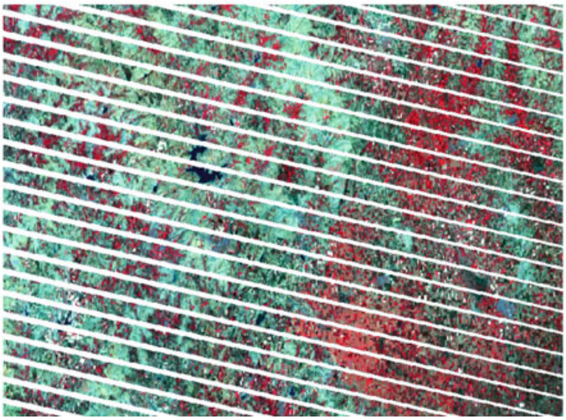
1.3 Results and Analysis

A. **SLC-Off Image (Raw Image)**

Figure 1.4 illustrates the raw image (distorted) acquired from the SLC-Off Sensor). The majority of image processing techniques developed to overcome this setback were contingent upon the use of SLC-on as primary imagery. These techniques suffered for their unpredictable rendering of various factors which changed over time and were, therefore, unsuitable for many of the systems. Various algorithms for gap filling methods of satellite image suffer from sharp radical changes in images due to change in sun glint change, snow, cloud, etc. These algorithms were having the concern in terms of computational time. Therefore the requirement of the powerful technique was a prerequisite for larger as well as a small area having less computational time. Therefore, the current work attempted to avoid these drawbacks through the statistical image processing method to provide a high level of accuracy for correct-



(a) Original Scene of Gulbarga District (Path-145/Row-048)



(b) Part of Scene 145/048 of Gulbarga District

Fig. 1.3 **a** Original scene of Gulbarga District (Path-145/Row-048). **b** Part of scene 145/048 of Gulbarga District

ing pixels from a single image via the techniques of one-dimensional interpolation and filtering.

B. **Processed Image**

Figure 1.5 depicts the processed satellite obtained after statistical image processing of the raw image.

Figures 1.6a and 1.6b exhibit the transformation occurred at the pixel level of the satellite image. The statistically processed images were compared with original images for the pixel distribution and to calculate RMSE values between each image. An analysis of the coefficients of determination of two-dimensional correction results, in terms of the pixel distribution, demonstrates the variation in the pixel data values. Therefore, Fig. 1.6a exhibits the original pixel values or digital numbers

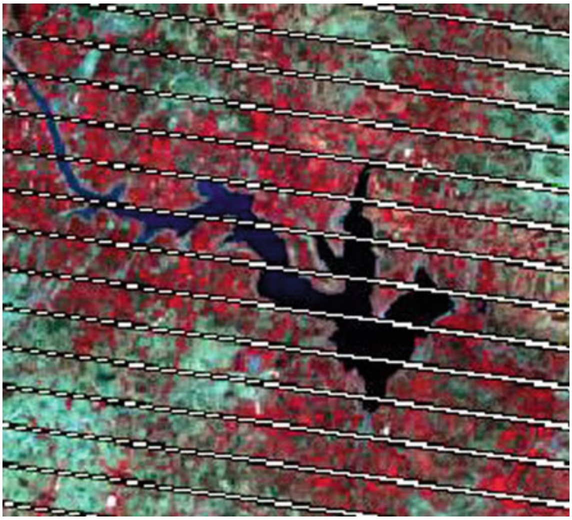
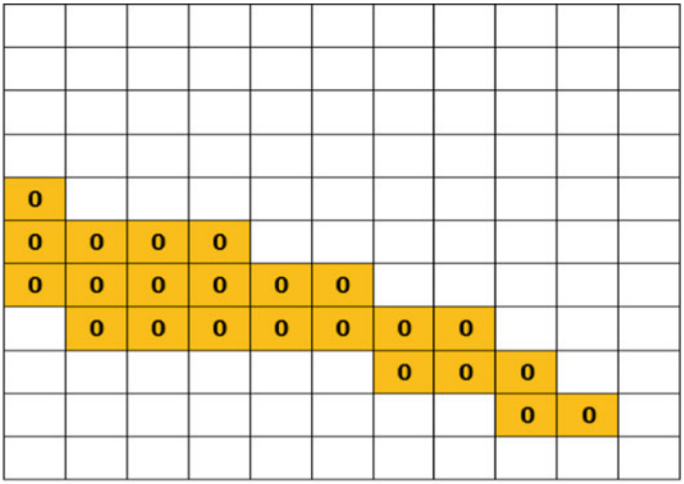


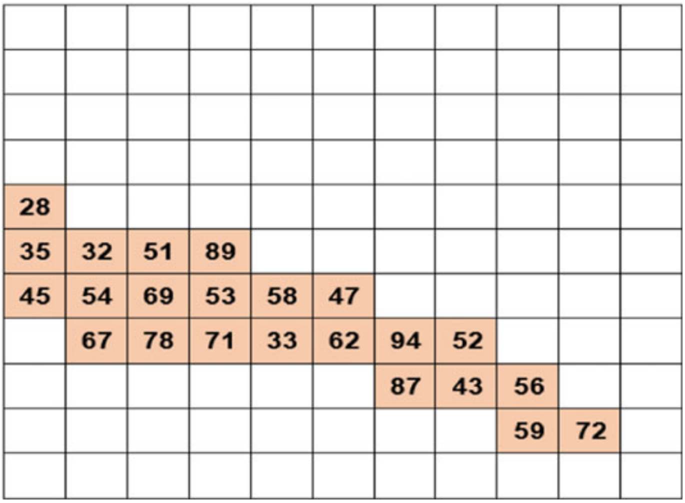
Fig. 1.4 Distorted original raw image

Fig. 1.5 Image after statistical processing

(DN) values in the distorted image and Fig. 1.6b depicts the values after applying statistical processing methods to the image.



(a) *Original DN (Pixel) matrix values in raw image*



(b) *Altered DN (Pixel) matrix values in processed image*

Fig. 1.6 Illustration for conversions in image in DN matrix values. **a** Original DN (Pixel) matrix values in the raw image. **b** Altered DN (Pixel) matrix values in the processed image

1.4 Conclusion

People were working, in the past, on ways to improve the severely damaged image quality for using the images more efficiently. The idea worked at least to some degree, but very little attempt was made for retrospectively improving the damaged scenes. The metamorphosis of the proposed system over the conventional algorithm is the theory of the statistical approach being applied for the missing pixel value estimation guided by the adjacent value rather than the distance pixel. As the image restoration processes take place in pixel by pixel manner so the calculation of each pixel is dependent on adjacent pixels. In other words, the proposed concept generates one pixel using the functions among adjacent directly surrounding the empty location, whose value is almost equal to the value generated by the conventional bilinear interpolation algorithm. The trial outcomes presented more superior images after restoring the image gaps to resolve the inconsistencies of the image to be used in any scientific analysis. The simulated trial validated that the proposed approach *(statistical/focal analysis approach)* as a finer image restoration approach in both visual and statistical aspects.

Acknowledgements We gratefully acknowledge USGS and NASA leadership and support of the Landsat Science Team. Landsat ETM+ data used in this study was downloaded from http://earthexplorer.usgs.gov/. Source for this data set is the Global Land Cover Facility, www.landcover.org. This work was undertaken as part of full-time PhD program and the work was supported by the DST-INSPIRE Fellowship [Grant Numbers IF120639] from Ministry of Science & Technology, Govt. of India for completing PhD work. This research is supported in part by SERB under Early Career Research Scheme (FILE NO. ECR/2017/000816).

References

1. Paper, O.: Validating gap-filling of landsat ETM + satellite images in the Golestan province, Iran. Arab. J. Geosci. **5** (2013)
2. Alfred, V.D.M.: Stein; Freek. Remote Sensing and Digital Image Processing. Springer, Berlin (2002)
3. Zhang, C., Li, W., Travis, D.: International journal of remote. Int. J. Remote Sens. **28**(768485448) (2007)
4. Chen, F., Zhao, X., Ye, H.: Making use of the landsat 7 SLC-off ETM + image through different recovering approaches. In: INTECH, pp. 317–342 (2012)
5. Blaschke, T.: Object based image analysis for remote sensing. ISPRS J. Photogramm. Remote Sens. **65**(1), 2–16 (2010)
6. Rogers, A.S., Kearney, M.S.: Reducing signature variability in unmixing coastal marsh thematic mapper scenes using spectral indices. Int. J. Remote Sens. **25**(12), 2317–2335 (2004)
7. Benz, U.C., Hofmann, P., Willhauck, G., Lingenfelder, I., Heynen, M.: Multi-resolution, object-oriented fuzzy analysis of remote sensing data for GIS-ready information. ISPRS J. Photogramm. Remote Sens. **58**(3–4), 239–258 (2004)
8. Blaschke, T., Hay, G.J., Kelly, M., Lang, S., Hofmann, P., Addink, E., Feitosa, R.Q., Van Der Meer, F., Van Der Werff, H., Van Coillie, F., Tiede, D.: Geographic object-based image analysis – towards a new paradigm. ISPRS J. Photogramm. Remote Sens. **87**, 180–191 (2014)
9. Gonzalez, R.C., Woods, R.E., Hall, P.: Digital Image Processing. Pearson, New York

10. Zeng, C., Shen, H., Zhang, L.: Recovering missing pixels for landsat ETM + SLC-off imagery using multi-temporal regression analysis and a regularization method. Remote Sens. Environ. **131**, 182–194 (2013)
11. Butt, A., Shabbir, R., Ahmad, S.S., Aziz, N.: Land use change mapping and analysis using remote sensing and GIS: a case study of simly watershed, Islamabad, Pakistan. Egypt. J. Remote Sens. Space Sci. (2015)
12. Wulder, M.A., White, J.C., Masek, J.G., Dwyer, J., Roy, D.P.: Landsat observations : short term considerations. Remote Sens. Environ. **115**(2), 747–751 (2012)

Chapter 2
Performance Analysis of Network with Different Queuing Mechanisms in TCP/FTP and UDP/FTP Scenario

Nehal Patel and Radhika Patel

Abstract Implementation, performance analysis, and network management are the leading issues in the vast field of computer. The choice of the several queues completely depends on the requirement of the broadcast of data. Safe and reliable propagation of data is an elementary obligation of a computer network. In the present situation, there is a strong necessity of calibration, testing, and extensive deployment of queue organization patterns in routers, which is liable for the enhancement of today's performance of the Internet. Queues presentation calculation needs a tangible research effort in the measurement as well as utilization of router workings, which developments to guard the Internet from drifts that are not adequately amicable to notification of congestion. In this paper, we assess the act of Drop Tail, RED, SFQ, and FQ by varying the queue size. We are representing the detailed performance analysis and comparison of the various queues in terms of throughput and packet loss.

Keywords NS2 · Drop tail · RED · SFQ · FQ · Packet drop · Queue size · Throughput

2.1 Introduction

The importance of Computer Networks and Internetworking layer has been tremendously increased in the recent decade. In the digitalized era of computer networks, sharing of information is only possible through networking where end-devices are connected via various links. But the transmission of the data packet in the network is carried out with the help of transport protocols. Among various transport protocols,

N. Patel (✉)
CSPIT, CHARUSAT, Changa, Gujarat, India
e-mail: nehalpatel.it@charusat.ac.in

R. Patel
DEPSTAR, CHARUSAT, Changa, Gujarat, India
e-mail: radhipatel999@gmail.com

A. K. Somani et al. (eds.), *Smart Systems and IoT: Innovations in Computing*, Smart Innovation, Systems and Technologies 141,
https://doi.org/10.1007/978-981-13-8406-6_2

TCP, i.e., Transmission Control Protocol is the most significant protocol consisting of perfect mechanism such as management of connections, error control, flow control, and congestion control.

The transportation of packets/message/information from any source to the desired destination through any medium at any instance of time entails a proper order of processes being done. Interface development is to be managed in order to complete a successful packet transmission [1].

Packets are being sent in the network through two mediums, namely, TCP/FTP sender and UDP/FTP sender. Analysis until the date delivers the knowledge that TCP/FTP sender technique for packet transmission is better. In TCP/FTP technique, TCP represents a protocol of transport layer and FTP is a protocol of application layer that represents traffic agent of a specific presentation through which TCP data is conduct [2].

TCP/FTP and UDP/FTP scenario offer reliable, bidirectional, and conforming characteristics. It has been found that the performance of the network differs according to the queuing mechanisms used. In this paper, the performance parameters such as packet delivery ratio and throughput are analyzed in NS2 using different queue management approaches in TCP/FTP and UDP/FTP scenarios. The next section describes all the queue management approaches in brief. In the remaining part, simulation environment and experimental results along with a conclusion and future work are described.

2.2 Queue Management Approaches

Queue management is expounded as the method which can manage the size of packet queues through packet dropping. It can be categorized into three groups [3] (Fig. 2.1).

2.2.1 Passive Queue Management

In PQM method, a router sustains a set of queues which holds packets for scheduling. For instance, Drop tail and Stochastic Fair Queuing [SFQ].

1. **Drop Tail**

Drop Tail is a modest queue mechanism that is utilized by the routers. Whenever queue or buffer is full, then incoming packets are dropped till queue or buffer has an adequate vacuum to accept new packets. It is the most extensively used due to its simple implementation and quite a high efficiency.

Unfortunately, drop tail is having some problems such as lack out, full queue, bias against bursty traffic and global synchronization.

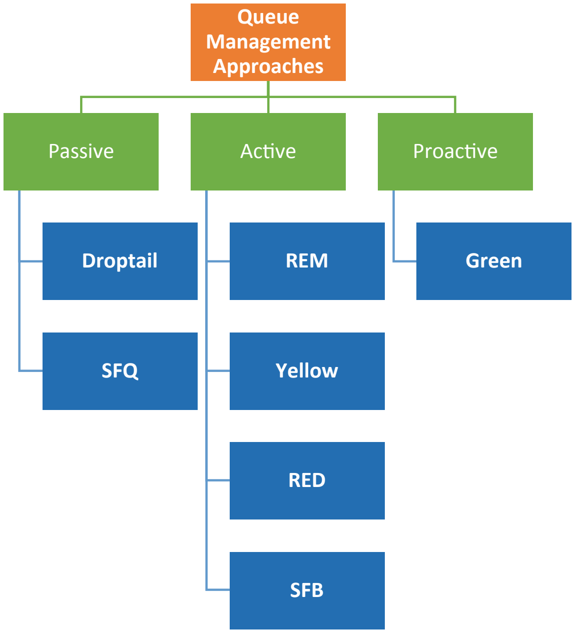


Fig. 2.1 Types of queue management approaches

2. **SFQ**

SFQ queuing mechanism is established on the fair queuing procedure and suggested by John Nagle in 1987. It practices a hashing scheme that distributes the traffic above a restricted number of queues. SFQ allocates a pretty large number of First In First Out (FIFO) queues [4].

2.2.2 *Active Queue Management*

AQM queuing mechanism is dropping packets before the router's queue is full. It is suggested to substitute a drop tail queue scheme in demand to increase network performance in relationships of link employment, system fairness, delay, and packet loss rate. There are many AQM algorithms like RED (Random Early Detection), SRED, REM (Random Exponential Marking), BLUE, SFB, etc. [6].

A. *REM*

It can achieve equally high consumption with minor packet loss as well as delay in a very modest and accessible way. The main idea is to decouple congestion measure from performance measure for instance delay, packet loss, and queue length [7].

B. *YELLOW*

For managing the problem of congestion, yellow practices the load aspect, i.e., link usage as a chief virtue. Along with link utilization, a queue control function is familiarized to upgrade congestion control performance. Yellow leave behind the newly anticipated AQM procedures in relation to link consumption, packet loss as well as robust performance over widespread recreations [8].

Yellow algorithm practices the disparity among the input amount and link capability as the prime metric. Moreover, the queue dimension is considered as a subordinate metric. Queue dimension shakes the load issue consuming Queue Control utility, which is figured out by a nonlinear hyperbola function of instantaneous queue length and reference queue size [8]. Yellow delivers an early controlling queuing delay preserving the main load value. The average queue length and standard deviation of queue length of Yellow are slightly affected by UDP flows [8].

C. *RED*

RED stands for Random Early Detection. It is an overcrowding prevention queuing contrivance, which is hypothetically useful, chiefly in high-speed transfer networks. It comes under the active queue managing mechanism. RED functions on the average queue size as well as drop packets on the source of statistics information. If the buffer is vacant all entering packets are accredited. The possibility of dumping a packet increases with the increase in the size of the queue. When the buffer is full probability and turns out to be 1 and all entering packets are dropped.

D. *SFB*

SFB, i.e., Stochastic Fair BLUE is an innovative practice for guarding TCP flows in contradiction of nonresponsive flows consuming the BLUE algorithm. SFB is extremely ascendable and imposes equality using a tremendously minor quantity of state and a minor quantity of buffer space [9]. It is based on two self-governing algorithms, namely, BLUE queue management algorithm and bloom filters. This algorithm uses a solitary marking possibly to spot packets at the time of congestion. The probability of spotting increases linearly with congestion. The subsequent algorithm is built on bloom filters [1]. This algorithm allows for the distinctive grouping of objects through the usage of numerous, self-determining hash functions. By means of bloom filters, object classification can be complete with an awfully minor quantity of state information.

2.2.3 Proactive Queue Management

A proactive queue management (PQM) algorithm known as Generalized Random Early Evasion Network smears acquaintance of the steady-state performance of TCP connections to dropped packets perceptively and proactively. It prevents congestion from ever happening and guaranteeing a greater grade of equality between flows.